JAXA PMM Program Status

Riko OKI (JAXA/EORC)

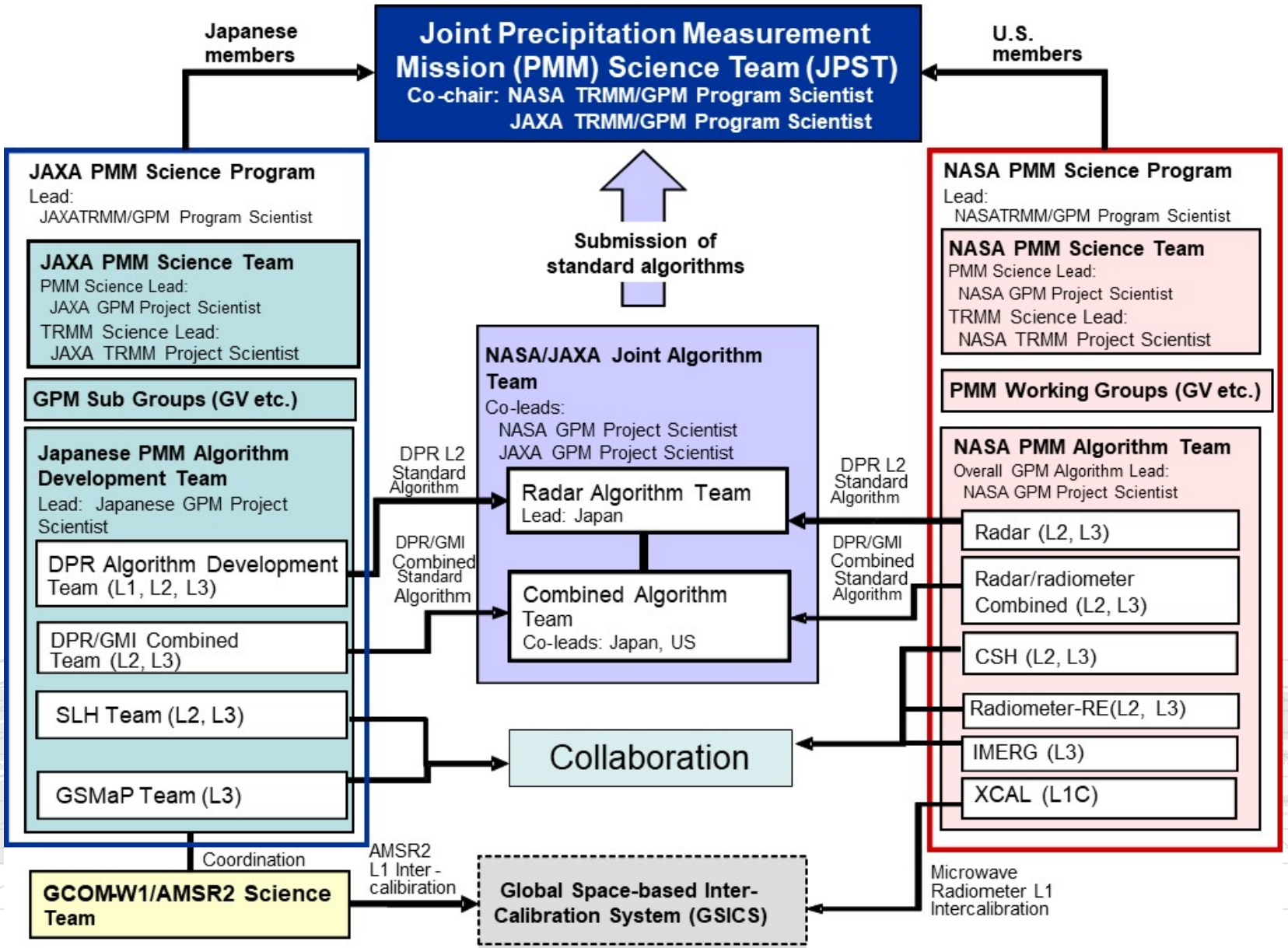
2019 PMM Science Team Meeting, November 2019

Japanese PMM Science Team

- The current Japanese PMM Science Team started in Apr. 2019 for three-year period.
  - 31 proposals for the EO-RA-2 (JFY2019-2021)
    - ✓ This RA includes almost all Earth Observation (EO) missions in the JAXA.
    - ✓ It is the 9th RA since the first TRMM RA, and the 5th as the PMM
  - 24 with research cost proposals
  - 7 no cost transfer proposals including 5 from abroad
  - Research Category
    - ✓ Algorithm development: 8
    - ✓ Validation: 13
    - ✓ Application research: 10

Japan and U.S. PMM Science Framework

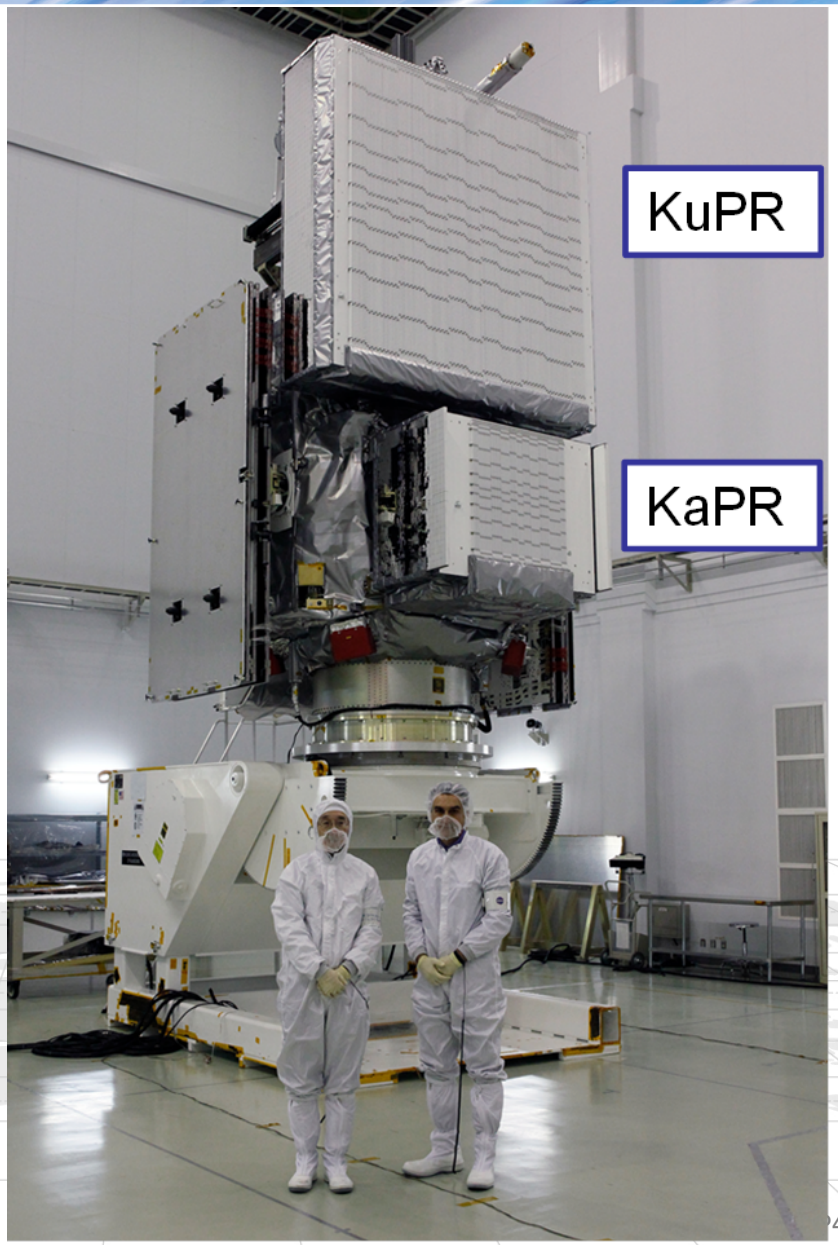
-- two joint algorithm development teams --



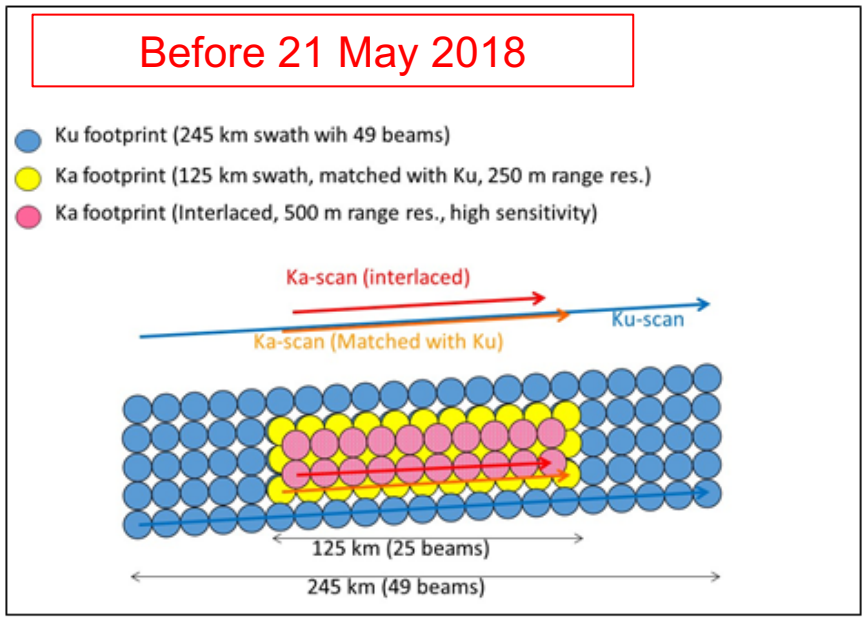
DPR Sensor Status

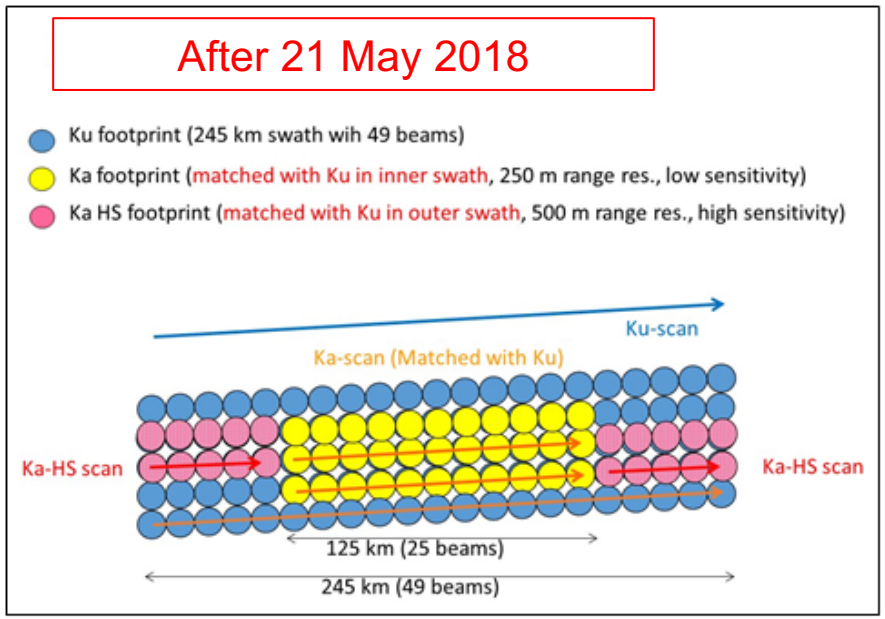
- JAXA is continuing DPR data monitoring to confirm that DPR function and performance are kept on orbit.
  - Operation Mode
  - Temperature
  - Bus Voltage and Current
  - System Noise
  - Sea Surface Radar Cross Section (σ0)
  - Internal Calibration
    - ～1 time / week
  - External Calibration
    - 2 periods / year (～5 times / period)
  - TX/RX Amplifier Status
    - 2 times / year

DPR data monitoring results show that there is no degradation of DPR function and performance from Launch till now.



KaPR's scan pattern change (May 2018)





- The KaPR's scan pattern has been changed in May 2018.
  - to apply the dual-frequency technique to a full swath
  - to improve the beam matching between KuPR and KaPR
- **L2/L3 product corresponding to the new scan pattern of the KaPR will be released as Version 06X soon.**
  - **V06X will be processed after May 2018.**

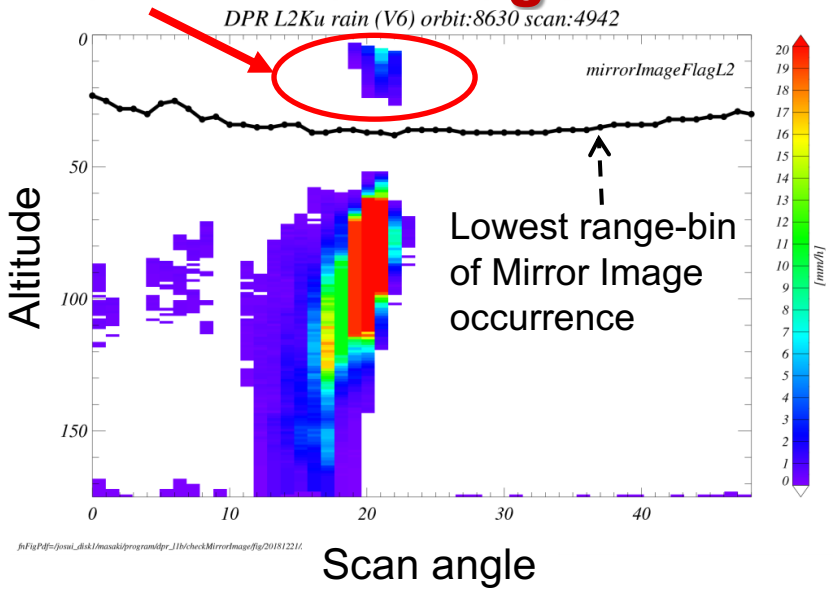
GPM Algorithm Development Status (Summary)

- GPM/DPR Level 1 algorithm (JAXA)
  - V05 product was released in May 2017.
  - See the following slide of our plan for the next version (V07) .
- DPR Level 2 and 3 algorithm (Joint Japan-U.S.)
  - V06A product was released in Oct. 2018.
  - V06X product corresponding to the KaPR scan pattern change will be released soon.
- DPR Latent heating algorithm (Japan-U.S.)
  - DPR Spectral Latent Heating (SLH) V06 product was released in Oct. 2018.
- Global Rainfall Map algorithm [GSMaP] (Japan)
  - V04 Product was released in January 2017.
  - V05 Product is scheduled to be released in July 2020.

DPR L1 Plan for V07

- We will not change the calibration of the DPR, and add a flag for mirror images.
- Mirror images in the DPR
  - ✓ This was motivated by Prof. Hirose (Meijo Univ) who found precipitation at unusual high altitudes.
  - ✓ The mirror image is a virtual image caused by the double reflection of echoes over the ocean, and connected with the doubtful precipitation at the high altitudes.
  - ✓ In V07, a calculation regarding the mirror image will be implemented in the DPR-L1, and this will be considered in the DPR-L2 algorithms to reduce the doubtful precipitation at the high altitudes.

Doubtful precipitation by the Mirror image

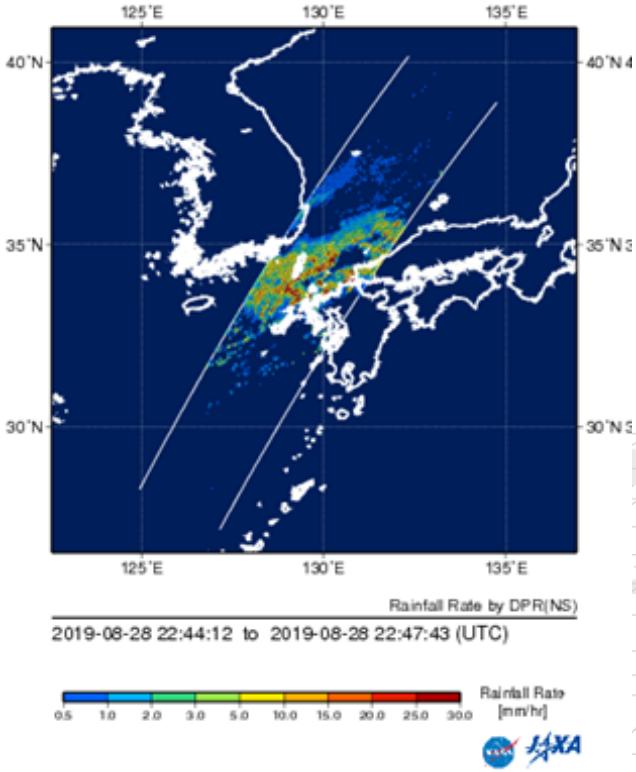


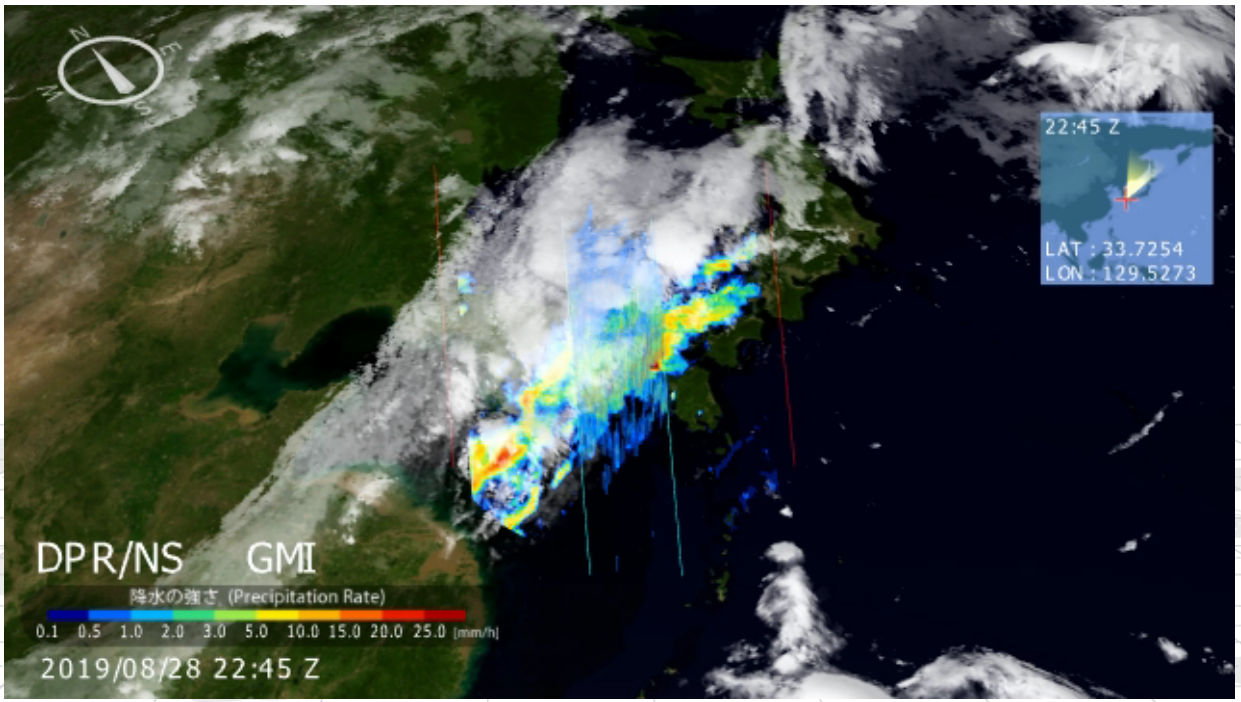
Vertical cross section of the KuPR's Precipitation rate (V06A):

Sep 5, 2015, at 07Z, over Naples
Orbit number: 8630
Scan number: 4942

Heavy rainfall over the north Kyusyu (Aug. 2019)

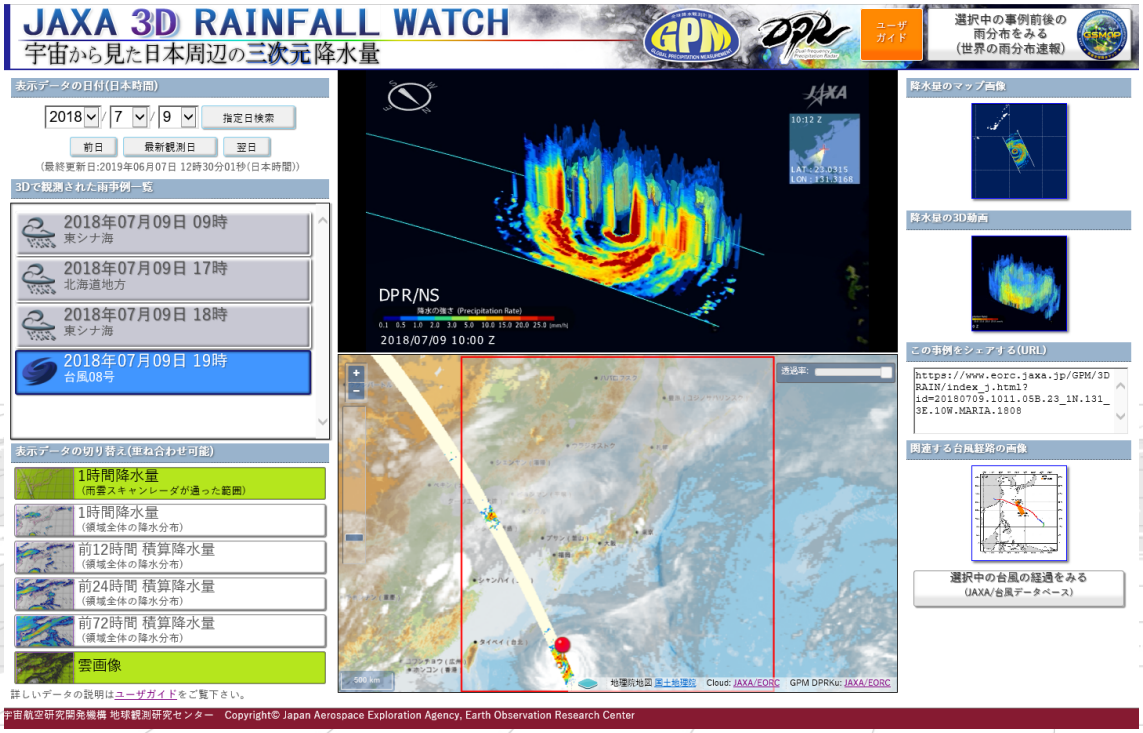
- Heavy rain occurred in the northern part of Kyushu in late August 2019, and the Japan Meteorological Agency (JMA) issued the Emergency Warning to the prefectures of Saga, Fukuoka and Nagasaki on August 28, 2019.
- GPM/DPR observed heavy rainfall in northern Kyushu observed at 7: 45 on August 29. GPM/DPR shows that the height of rainfall reaches 14 km in heave y rainfall areas.





JAXA 3D RAINFALL WATCH

- DPR monitoring website around Japan **started in July 2019**
  - 3D movie of the DPR observations are produced automatically when heavy rainfall thresholds are satisfied and visitors can download it from the website.
  - Overlay the DPR orbital rainfall information, GSMaP rainfall distribution (1h, 24h, 24h and 72h) and IR cloud information.

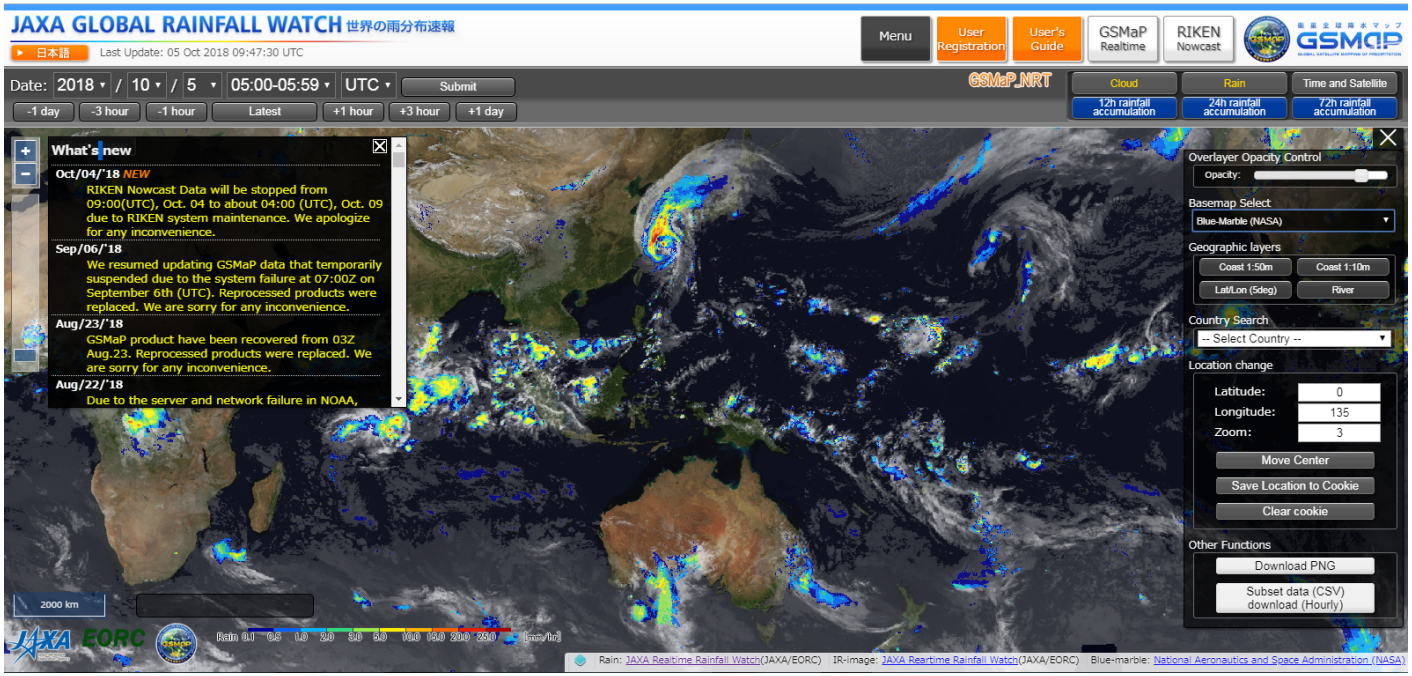


https://www.eorc.jaxa.jp/GPM/3DRAIN/index_j.html

The current website was only by the Japanese (sorry).

Global Satellite Mapping of Precipitation (GSMaP)

http://sharaku.eorc.jaxa.jp/GSMaP/



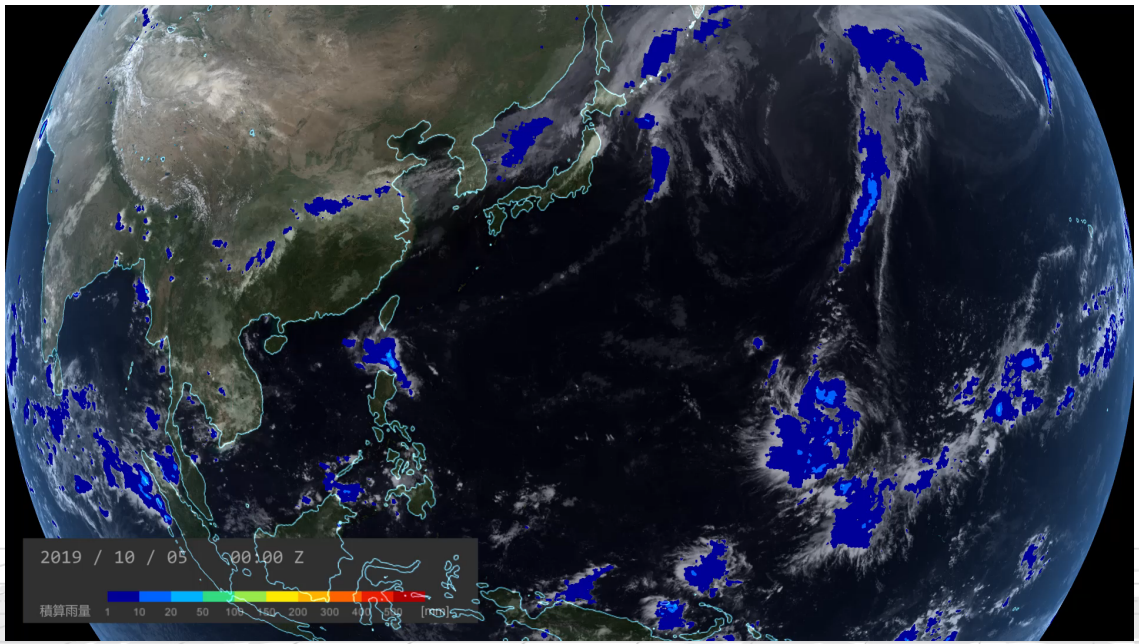
Registered users:
5380 users
128 counties
(Oct. 2019)

- GSMaP is a blended Microwave-IR product and has been developed in Japan for the GPM mission.
  - U.S. counterpart is “IMERG”
  - GPM-GSMaP V03 (algorithm version 6) was released in Sep. 2014, and GPM-GSMaP V04 (algorithm version 7) was released in Jan. 2017.
  - GPM-GSMaP V05 (algorithm version 8) will be released in July 2020.
  - Real-time version, GSMaP_NOW has been extended to the whole globe since Jun. 2019 (See Dr. Kubota’s presentation)

Super Typhoon HAGIBIS (Oct. 2019)

- Super Typhoon HAGIBIS in Oct. 2019 caused widespread damage across Japan, particularly in the eastern part of the Honshu island.

Accumulated precipitation amount by the GSMaP (5^{th}-13^{th} Oct. 2019)

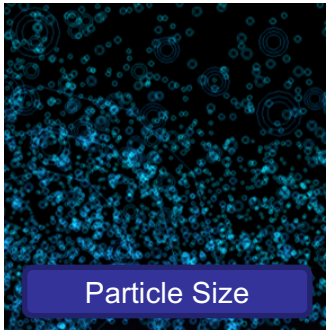


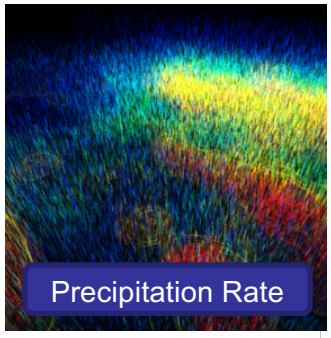
(photo by NHK)

Typhoon Hagibis was borne in the tropical Pacific Ocean, and moved northward toward the Japan with increasing iintensities. In particular, heavy rainfall of over 500 mm in total occurred in parts of the Kanto and Tohoku regions, causing inundation in various regions.

DPR observation in VR

- JAXA developed visualization system of DPR observation in VR.





- You can enjoy these visualization using your own smart phone or tablet PC via YouTube.

JAXA EORC

YouTube

https://www.youtube.com/channel0/UChnDRdGjFzNufOfLDOhrlvA

Hurricane DORIAN, 4th Sep. 2019

Awards by the Meteorological Society of Japan

- Recently, the Meteorological Society of Japan (MSJ) awarded the following Japanese PMM researchers.
  - The Award of the Meteorological Society of Japan
    - Prof. S. Shige (Kyoto Univ) in 2018
      - “Development of estimation method of latent heat and precipitation based on satellite observation and elucidation of topographic rainfall characteristics in the Asian monsoon region”
    - Prof. H. Masunaga (Nagoya Univ) in 2019
      - “Study of tropical convection dynamics by analysis of integrated satellite observation data”
  - The Gambo-Tatehira Award
    - Dr. K. Aonashi (JMA/MRI) and Dr. T. Kubota (JAXA) in 2019
      - "Achievements related to development of global precipitation map by satellite observations and promotion of its applications in society"

Please contact to Prof. S. Shige (Chief Editor) when you're interested.

Call for Papers: Special Edition on

"Global Precipitation Measurement (GPM): 5th Anniversary"

in Journal of the Meteorological Society of Japan (JMSJ)

This special edition accepts papers related to studies on GPM including analysis and applications as well as algorithm developments. The special edition also accepts papers on studies using the long-term TRMM data and research carried out for a future satellite mission.

Please submit the manuscripts on the online submission system: https://mc.manuscriptcentral.com/jmsj

JMSJ (IF: 5.023)

Important dates

- Deadline of submission: 31 March 2020
- Publication: In regular issues of 2019-2020

(The authors are not penalized by having to wait for everyone else's paper to be published.)

The first published paper!

Wang, J., R. Houze, J. Fan, S. Brodzik, Z. Feng, and J. Hardin, 2019: The detection of mesoscale convective systems by the GPM Ku-band spaceborne radar. *J. Meteor. Soc. Japan*, **97**, https://doi.org/10.2151/jmsj.2019-058.

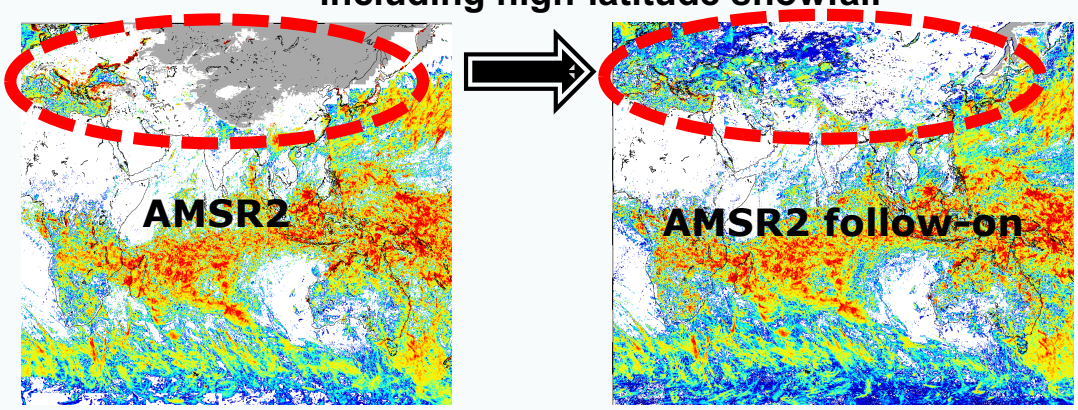
Information page for the JMSJ special edition on GPM: "https://jmsj.metsoc.jp/special_issues_editions/GPM.html"

PMM-related JAXA updates: AMSR2 follow-on mission (AMSR3)

- AMSR3 will share the satellite bus with GOSAT-2 (Greenhouse gases Obseving SATellite-2) follow-on mission
- Launch date: no earlier than 2022

✓ AMSR3 will have new high-frequency channels (166 & 183 GHz) for solid precipitation retrievals and water vapor analysis in numerical weather prediction.

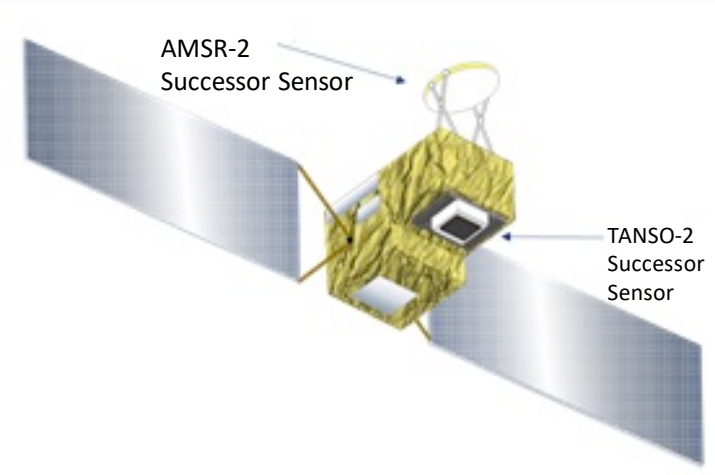
Capable of observing global precipitation including high-latitude snowfall



Mission Targets

- Understanding water cycle variation and impacts of climate change
- Improvements in numerical weather prediction, typhoon analysis, etc.
- Contributions to fisheries near coast
- Contribution to navigation support in polar oceans

✓ GOSAT-2/TANSO-2 successor sensor will improve observation capability of greenhouse gases.



New standard products

- solid precipitation, water vapor over land, high-resolution sea surface temperature, all-weather sea surface wind speed and high-resolution sea ice concentration

PMM-related JAXA updates: Current status of AMSR3

- Specification of the AMSR3 instrument
  - Almost equivalent to AMSR2 onboard the GCOM-W satellite
  - Additional high frequency channels (166 and 183 GHz) are planned for snowfall retrievals and NWP applications
- Orbit will be 666 km altitude (same as GOSAT) and 13:30 LT in Ascending node (same as GCOM-W)
  - Finer FOV (5% less), narrower swath width (1535km)
- JAXA proceeds with internal process to launch development project.
  - Mission Definition Review (MDR) and project readiness reviews were completed in Jun. 2018.
  - Project Preparation Phase (Phase A) activities since Sep. 1, 2018.
  - Currently preparing for Project Approval Review. Expect to start Phase-B in late 2019.

Summary

- The Japanese PMM Science Team started in Apr. 2019 for three-year period.
  - 31 proposals for the EO-RA-2 (JFY2019-2021)
- GPM/DPR instrument is working well.
- GPM products V06 were recently released to the public.
  - **JAXA 3D RAINFALL WATCH (https://www.eorc.jaxa.jp/GPM/3DRAIN/index_j.html)**
- Global rainfall map product (GSMaP)
  - New V05 (algorithm version v8) will be released in 2020.
- PMM-related news
  - Awards by the Meteorological Society of Japan (MSJ)
  - GPM 5th Anniversary special edition in JMSJ
- AMSR-3 status
  - AMSR3 will share the satellite bus with GOSAT-2 follow-on mission
  - Launch date: no earlier than 2022

PMM-related JAXA updates: AMSR-E Reprocessing

- To provide consistent dataset between AMSR2 and AMSR-E for long-term analysis, JAXA has reprocessed AMSR-E product applying the latest AMSR2 algorithms.
- AMSR-E L1 Ver.4 is available at the JAXA G-Portal system (https://www.gportal.jaxa.jp/gp/)
  - Brightness temperature (TB) between AMSR-E and AMSR2 is not adjusted
  - **Swath width of AMSR-E** (**1450km**) is extended to **be equivalent to that of AMSR2** (**1620km**) by scan bias correction at scan edges
  - Improved method to calculate hot load temperature correction by using two orbit paths to resolve gaps between Ascending and Descending orbit products
  - Improved geometric parameters
  - **AMSR-E L1R (resampling) product**, which is highly requested by users, are newly developed
- AMSR-E L2 Ver.8 reprocessing was completed and started to release via the G-Portal system.